

PROPOSITION DE POST-DOCTORAT

Intitulé : Autonomous navigation skills for a quadruped robot

Référence : **PDOC-DTIS-2021-03**
(à rappeler dans toute correspondance)

Début du contrat : January 2022

Date limite de candidature : December 2021

Durée : 12 mois, éventuellement renouvelable une fois - Salaire net : environ 25 k€ annuel

Mots clés :

Autonomous navigation, Robot skills, AI, Quadruped Robot SPOT

Profil et compétences recherchées

Algorithms for autonomous navigation (SLAM, pose estimation, path planning)

Good knowledge of the ROS/ROS2 middleware

Présentation du projet post-doctoral, contexte et objectif

Autonomous robotic systems are a common tool to perform complex missions, such as inspection of infrastructures, monitoring of the environment, or post-disaster situation assessment. To be confident in the use of autonomous systems, these must guarantee a robust behaviour when facing hazardous situations, such as failures of sensors or processing. Developing a complete functional architecture that implements intelligent behaviours robust to such failures is heavy work. However, the use of formal models of these functionalities will allow using model-checking or verification techniques to give guarantees on the robot behaviour.

At ONERA, we have developed such a formal modelling framework for robot skills [1], along with a toolchain to generate code and analyse models. This framework has been evaluated using Unmanned Ground Vehicles (UGVs) and Unmanned Aerial Vehicles (UAVs), on some missions involving mainly robot motions towards objects to observe or survey [2].

The objective of this post-doctoral study is to improve the capabilities of the robotic platforms owned at ONERA, and more specifically of a quadruped robot SPOT equipped with LIDAR and vision sensors, by integrating new intelligent functions [3]. Depending on the scientific background of the post-doctoral candidate, the objective will be to implement intelligent functions such as SLAM, Detect and Follow, Advanced Control, Object Segmentation, ...

In addition to developing these functionalities, integrating and testing them on the platform, the objective is to formalize these new skills using the robot skills framework [1], and evaluate both the models and the actual implementation in the perspective of improving the autonomous and robust behaviours of the robot.

The post-doctoral candidate will be integrated in the Autonomous Robotics Lab of ONERA/DTIS, Toulouse. The candidate will take part of the regular meetings and development sessions, outdoor experiments, involving under-graduate, Ph.D. or post-doctoral students, as well as senior researchers. The candidate will also be encouraged to publish the results on prestigious robotics conferences and journals.

[1] C. Lesire, D. Doose and C. Grand, "Formalization of Robot Skills with Descriptive and Operational Models," 2020 *IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS)*

[2] A. Albore, D. Doose, C. Grand, C. Lesire and A. Manecy, "Skill-Based Architecture Development for Online Mission Reconfiguration and Failure Management", 2021 3rd Int. Workshop on Robotics Software Engineering (RoSE'21)

[3] D. Wallace, Y. H. He, J. Chagas Vaz, L. Georgescu and P. Y. Oh, "Multimodal Teleoperation of Heterogeneous Robots within a Construction Environment," 2020 *IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS)*

Collaborations extérieures

Laboratoire d'accueil à l'ONERA

Département : Département Traitement de l'Information et Systèmes

Lieu (centre ONERA) : Toulouse

Contact : Christophe Grand

Tél. :

Email : christophe.grand@onera.fr